TECHNICAL facts

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Sequestration

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COAL-BASED IGCC OFFERS CO_2 CAPTURE BENEFITS FOR OIL RECOVERY

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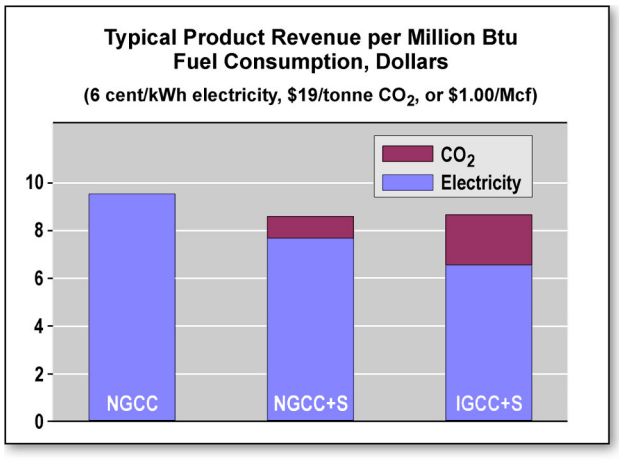
Background

As the demand for electricity steadily increases and concerns grow about greenhouse gas emissions, scientists are focusing on a coal-based technology that holds promise for addressing these issues. The technology, Integrated Gasification Combined Cycle equipped with a carbon capture and sequestration system (IGCC+S), can produce electricity at a competitive price, clean the environment of the most important greenhouse gas — carbon dioxide (CO_2) — and use the CO_2 as a valuable by-product to recover additional oil from mature reservoirs.

Scientists compared IGCC+S with two other approaches to determine how each would fare in a U.S. market that assumes an increased use of CO_2 to squeeze more oil out of mature reservoirs in a process called Enhanced Oil Recovery (EOR). The two other approaches were Natural Gas Combined Cycle (NGCC) and NGCC equipped with CO_2-capture technologies (NGCC+S). IGCC+S and NGCC+S, now in various phases of research and development, should be ready for commercialization within the decade. Selling the captured CO_2 for use in EOR projects could help offset the costs of these technologies while producing afford-able electricity and cleaning the environment.

At current and expected prices for natural gas, NGCC is the least expensive generating technology available. Economic projections show that it will provide the majority of additional generating capacity required by the United States over the next several decades. The present study was undertaken to determine if IGCC+S could be cost-competitive with NGCC if the captured CO_2 were marketable for use in EOR. This IGCC+S technology captures 90 percent of generated CO_2, which means that the net emission of CO_2 would only be about one-fifth as large per kilowatt-hour as emissions from NGCC.



Coal-Based IGCC Offers CO_2 Capture Benefits for Oil Recovery

Description

Scientists from the U.S. Department of Energy's (DOE) National Energy Technology Laboratory and the Pacific Northwest National Laboratory compared the economics of the three fossil-fuel technologies. They conducted the study to determine the price of electricity and the rate of return on invested capital expected for each of the three fossil-fuel systems. They further assumed that the systems would be built by 2010 and would operate for 20 years. Assumptions on fuel price, thermal efficiency, costs of coal and natural gas, and selling price of electricity and CO_2 were taken into account. The comparison resulted in the following conclusions.

NGCC's CO_2 emissions are less than half of those produced by an IGCC without carbon capture. But, an IGCC+S produces only one-fifth the carbon emissions of the most efficient NGCC. If reducing CO_2 emissions becomes important, an IGCC+S represents a significant improvement over NGCC.

NGCCs equipped to achieve 90 percent carbon capture are not as efficient as an IGCC+S, and the capital cost for providing capture is greater for NGCC than for IGCC. The cost difference is attributed to differences in the capture methods employed in the two generation approaches: from the flue gas in a NGCC and from a synthesis gas in an IGCC. The study indicates that the price of electricity generated by NGCC+S would be higher than that generated by either NGCC (without capture) or IGCC+S.

A large factor in the comparative costs of coal- and gas-based generation systems is fuel price. Compared with the price of oil and natural gas, the price of coal is expected to be stable. In fact, coal prices are expected to decline in the next two decades while the price of natural gas is projected to more than double for the same period. Price projections prepared by DOE's Energy Information Administration were used in the study. A large variability in the price of oil is also projected. In the study, the value of CO_2 for practice of EOR was estimated from published predictions of oil prices by using an historic linkage of prices for the two commodities.

Benefits

When they completed their study, the scientists concluded that IGCC+S could produce electricity profitably in a competitive market with no government subsidy for avoided carbon emissions, as is sometimes invoked as a means of bringing low carbon-emitting technology into the market. The profitability of NGCC is expected to be greater than that of IGCC+S, but uncertainty associated with the return on investment is greater for NGCC than for IGCC+S because of uncertainty of natural gas prices in the future. And finally, the potential for oil recovery is significant. When CO_2 is used for EOR, it can yield an additional 7 to 15 percent of the original oil in a reservoir and extend the life of the field by 15 to 30 years.

CO_2-EOR: The U.S. Landscape

- 66 Projects: > 190,000 bbl/day enhanced production
- 5 CO_2 Domes: > 1300 MMcfd, 30 TCF recoverable reserves (50+ years worth)
- Other CO_2 Sources
- CO_2 Pipeline Infrastructure